

M30	21.8
-----	------

960.81 Basis of Payment.

The furnishing, fabricating, erecting and painting of all structural steel and all metal work for the structure not otherwise provided for, will be paid for at the contract unit price per kilogram under the item for Structural Steel, complete in place.

To avoid delay in computation of the mass for partial and final payment, the Contractor shall submit his/her computations for the steel shown on each of the approved shop drawings as soon as practicable after the sheet has been approved. The computation by the Contractor shall show the mass for each member, except that duplicate members may be grouped together.

960.82 Payment Items

960.	Structural Steel	Kilogram
999.960	Structural Steel on Hand	Kilogram

SECTION 965

**MEMBRANE WATERPROOFING AND
PROTECTIVE COURSE FOR BRIDGE DECKS**

DESCRIPTION

965.20 General.

Membrane waterproofing applied to the surface as indicated on the plan and elsewhere as directed shall consist of one of the following systems:

1. Coal tar emulsion reinforced with two plies of coated glass fabric.
- *2. Hot applied rubberized asphalt membrane.
- **3. Preformed sheet systems - either reinforced rubberized asphalt or reinforced tar and resin.

The protective course will be bituminous concrete. Type of mix shall be Dense Binder Course as specified in Table A of Section M3.11.03 and placed in accordance with Item 965.62 hereinafter.

- * System 2 shall *not* be used on grades in excess of 3 percent.
- ** System 3 is the only system acceptable for butted deck beam and box beam superstructures.

MATERIALS

965.40 General.

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Protective Seal Coat Emulsion (Coal Tar Emulsion)	M3.03.3
Coated Glass Fabric	M3.06.1
Bituminous Concrete	M3.11.00
Thermoplastic Asphalt Membrane	M3.04.2
Asphalt Primer	M3.02.1
Preformed Sheet Membrane	M9.08.0

Portland Cement

M4.01.0

CONSTRUCTION METHODS**965.60 Preparation of Surface.**

All concrete surfaces which are to be waterproofed shall be screeded to the true cross section. Depressions shall be filled to a smooth flush surface with 1:2 mortar (1 part cement to two parts sand) or an approved rapid setting patching mortar. Other surfaces shall be trimmed free of rough spots, projections or other defects which might cause puncture of the membrane.

No waterproofing shall be done in wet, damp or foggy weather, nor when the ambient temperature is 5 °C or below, without permission of the Engineer.

The membrane waterproofing on bridge decks shall not be placed unless the Contractor is ready to follow within 24 hours with the first layer of bituminous concrete pavement; a longer period of time will be allowed only with the approval of the Engineer.

Immediately prior to the membrane application, the concrete surface shall be thoroughly swept and blown clean with an air compressor to remove any loose debris.

965.61 Application.**A. System 1 – Coal Tar Emulsion reinforced with two plies of Coated Glass Fabric.**

Apply the first coat of coal tar emulsion on a dampened but puddle free concrete surface. Application shall be made by squeegees or suitable push broom. The emulsion shall be evenly spread to a uniform thickness. When this application is thoroughly dry a second application of emulsion shall be placed at the same rate of spread. Immediately following the second application the first ply of coated glass fabric shall be laid. After the second application of emulsion with fabric has thoroughly dried, the third and fourth applications of emulsions shall be spread.

No applications of emulsion shall be spread until the previous application has thoroughly dried.

Immediately after the fourth application of emulsion the second ply of coated glass fabric shall be laid at a right angle to the first ply. This shall be followed by the fifth application of emulsion. All applications of coal tar emulsion shall be uniformly spread at a minimum rate of 0.6 liters per square meter.

The coated glass fabric shall be laid with edges slapped at least 75 millimeters. The first ply shall be laid transverse to the center line of the bridge and the second ply parallel with the center line.

Where curb or edging is placed, the membrane shall be turned up as shown on the plans.

Where membrane waterproofing is placed abutting steel expansion joints, scuppers, manholes or other metal projecting through the concrete, the membrane will be turned up about 40 millimeters and sealed to the metal.

The bituminous overlayment shall be placed within 24 hours, in accordance with Item 965.62, but not before the membrane has completely cured.

B. System 2 – Thermoplastic Asphalt Membrane.

Surface preparation shall be the same as in Item 965.60 with the added requirement that if the concrete surface is damp it shall be dried by use of a propane gas torch or similar equipment. Immediately prior to the application of the primer and by use of an air compressor, the surface shall be blown clean of all debris, dust, etc.

Priming:

The primer shall be applied by a hand sprayer, or similar equipment. Application shall be at the rate recommended by the manufacturer of the thermoplastic membrane.

The primer shall *thoroughly dry* before application of the thermoplastic membrane.

Membrane Application:

Melting of the thermoplastic membrane shall be done in a double jacketed indirect-fired heating kettle. Oil shall be used as the heat transfer medium. The kettle shall be equipped with a suitable agitator and temperature gauges for both the kettle and the oil-bath jacket.

Sufficient lead time shall be allowed for heating of the thermoplastic so that it will be in a fluid state at the time scheduled for application. Usually two to three hours are required for this phase of the operation.

A few packages of the thermoplastic shall be placed in the heating kettle and continuously agitated until thoroughly fluid. More material shall be added until the kettle is full and the material is fluid. As material is drawn off for application, additional packages shall be added.

Caution should be observed that the melting temperature does not exceed manufacturer's recommendation. This is usually between 175 °C to 220 °C. When fluid, the material shall be drawn off in suitable containers and poured onto the primed and dried deck surface.

It shall be evenly spread with squeegees to a minimum thickness of 3 millimeters. All horizontal surfaces shall be completely covered and vertical surfaces (curbing, edging, etc.) shall be covered up to a minimum of 100 millimeters.

Cracks greater than 2 millimeters but less than 12 millimeters shall be covered with 150 millimeter to 300 millimeter wide strips of butyl or neoprene sheeting. The sheeting shall be embedded in the freshly spread hot membrane material. A second coat of membrane material shall be spread overlapping the strip edges at least 100 millimeters.

After application of the membrane is completed and the material has set, it shall be dusted thoroughly with dry portland cement. This will eliminate all tackiness.

To eliminate any possible damage to the membrane and in accordance with Subsection 965.62, the bituminous overlayment shall be applied as soon as possible. The only caution that must be observed is that the paving spreader travel in a straight course and not make any turns that could cause damage to the membrane.

C. System 3 – Preformed Sheet Membranes.

This system shall consist of the application of preformed reinforced rubberized asphalt or reinforced tar and resin sheet membranes.

Composition and dimensional requirements shall be as stipulated by the manufacturer of the sheet membrane.

Membrane application shall be in accordance with the manufacturer's instructions. The only exception, if required by the manufacturer, shall be the need for a separation or protection layer. As with System 1 and 2, the first course of the bituminous concrete overlayment shall serve as the protective course.

The bituminous overlayment shall be placed as soon as possible and as described in Subsection 965.62.

965.62 Bituminous Concrete Protective Course.

The first course of the bituminous concrete overlayment shall serve as the protective course. It shall be placed within 24 hours after the membrane has been installed.

The bituminous concrete protective course shall be spread upon the entire membrane to a finished depth as specified in accordance with the following requirements:

The precautions hereinbefore noted for Section 460, Bituminous Concrete Pavement, shall be strictly observed.

1. Spreading Mixture.

a. The use of rubber tired mechanical pavers and trucks on the membrane during the paving operations will be permitted provided workmanship is satisfactory to the Engineer. If work is judged unsatisfactory, the Engineer will require that subsequent placement be by hand.

b. Hand spreading of the mixture shall be accomplished by dumping the mixture from the trucks onto metal or wooden platforms which shall be of such a size that the mixture will not fall off when dumped thereon or work off during spreading. Each load of mixture shall be dumped outside of the area over which it will be spread and only as fast as can be handled by the shovelers. The mixture shall be deposited upon the membrane with shovels and spread with lutes, care being taken not to spread the mixture faster than it can be handled by the rakers.

2. Compacting.

After the mixture has been properly spread, it shall be rolled. Delays in the initial rolling of the freshly placed mixture will not be permitted. In all places inaccessible to a roller, the required compression shall be secured with hot tampers. Rolling shall be done with a roller conforming to the requirements as specified for Class I-1 Bituminous Concrete in Section 460, except where power rollers are impracticable to use, approved hand rollers and tampers shall be used, as directed. Steel wheel rollers will not be allowed on bare membrane.

3. Joints.

The bituminous concrete shall be so placed that the number of joints required shall be reduced to a minimum. Where joints are necessary, they shall be constructed in the manner specified in Section 460. Edges of the bituminous concrete at the edge of parapets shall be protected by planks which shall be firmly secured and left in place until the course has been properly rolled and is thoroughly set.

No bituminous work shall be done during rainy weather or when weather conditions as to temperature or otherwise are, in the Engineer's judgment, unsuitable for obtaining satisfactory results.

COMPENSATION**965.80 Method of Measurement.**

Membrane waterproofing for bridge decks will be measured by the square meter and the quantity to be paid for shall be the number of square meters of surface covered with no allowance for overlapping or for edges turned up or carried into recesses for seals, except that the area of the full membrane turned down in back of the backwalls and extended under and in back of curb or edging will be included for payment.

The protective course will be measured by the metric ton and the quantity to be paid for shall be the actual and verified tonnage, complete in place, and approved.

965.81 Basis of Payment.

The membrane waterproofing will be paid for at the contract unit price per square meter under the item for Membrane Waterproofing for Bridge Decks, complete in place.

The mass of protective course will be paid for at the contract unit price per metric ton, complete in place.

965.82 Payment Items.

965.	Membrane Waterproofing for Bridge Decks	Square Meter
462.	Class I Bituminous Concrete Dense Binder Course	Metric Ton

SECTION 967**MEMBRANE WATERPROOFING AND PROTECTIVE COURSE
FOR ABUTMENTS AND WINGWALLS****DESCRIPTION****967.20 General.**

Membrane waterproofing applied to the surface indicated on the plan and elsewhere as directed shall consist of one of the following systems:

- (1) Coal tar emulsion reinforced with two piles of coated glass fabric.
- (2) Biodegradable corrugated kraft paper panels with flutes filled with bentonite and ends sealed.

The protective course, if required, will be cement concrete brick, cement concrete block or protection board as specified by manufacturer.

MATERIALS**967.40 General.**

Materials shall meet the requirements specified in the following Subsections of Division III, Materials:

Protective Seal Coat Emulsion (Coal Tar Emulsion)	M3.03.3
Coated Glass Fabric	M3.06.1
Cement Concrete Brick	M4.05.0
Cement Concrete Block	M4.05.1
Portland Cement	M4.01.0
Bentonite Panels	M9.09.0